Combination of the Latest Releases of GRACE Monthly Gravity Field Solutions

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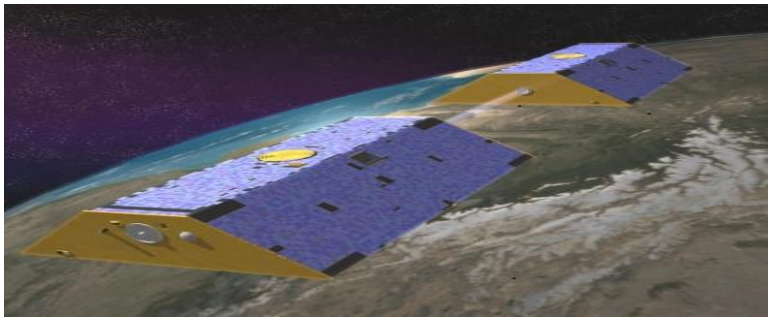
Combination of GRACE Monthly Gravity Solutions

GRACE MISSION



- To make use of the solutions from different processing strategies
- **Reduced systematic errors** specific for certain processing centers
- **Reliable and consistent** solutions
- Benefits for users of GRACE gravity solutions without advanced knowledge or preference
- Project EOSIEM **E**uropean **G**ravity **S**ervice for **I**mproved **E**mergency **M**anagement

Available GRACE Monthly Gravity Solutions

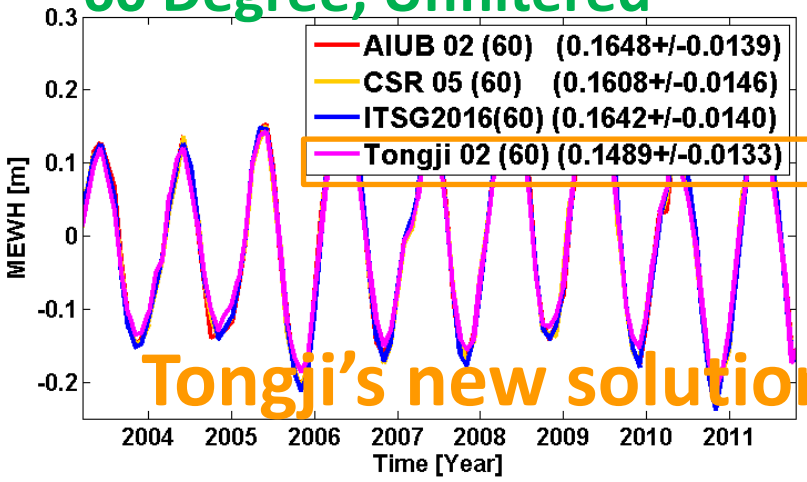
The official **GRACE monthly gravity solutions**

available at the ICGEM website (`http://icgem.gfz-potsdam.de/ICGEM`):

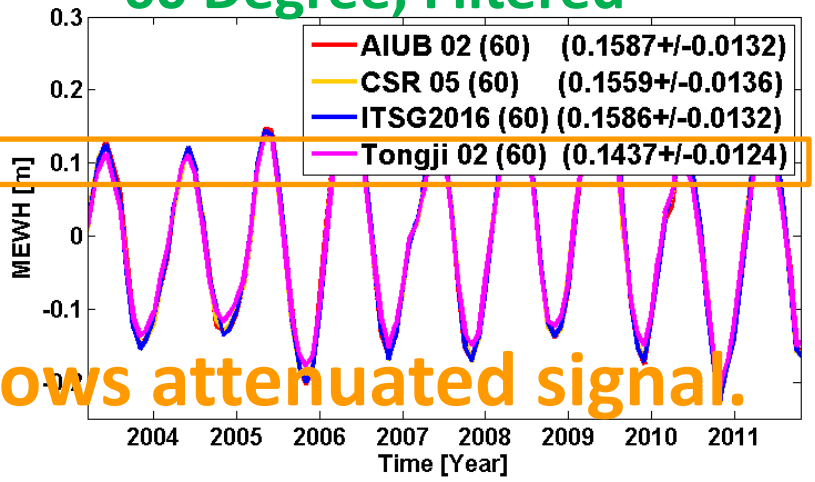
Processing Center	Maximum Degree	Release #	New Release in 2016	In the Combination
AIUB	**60,90**	**RL02**	**-**	**Included**
CSR	**60,96**	**RL05**	**-**	**Included**
GFZ	**90**	**RL05**	**-**	**Included**
ITSG	**60,90,120**	**2014**	**2016 (60,90,120)**	**Included**
JPL	**60,90**	**RL05**	**-**	**Included**
Tongji Univ.	**60**	**RL01**	**RL02 (60)**	**Included**
DMT	120	RL01	-	Not Included (∵ Pre-filtered)
GRGS	80	RL03	-	Not Included (∵ Pre-filtered)

Comparison: Signal (MEWH)

60 Degree, Unfiltered

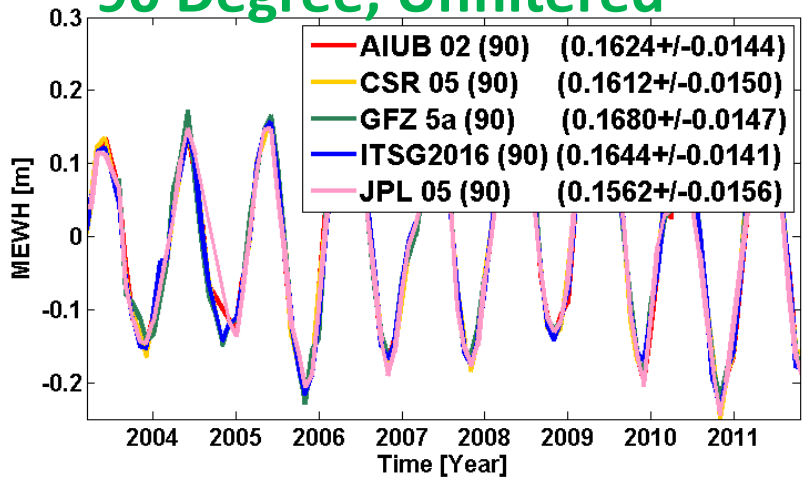


60 Degree, Filtered

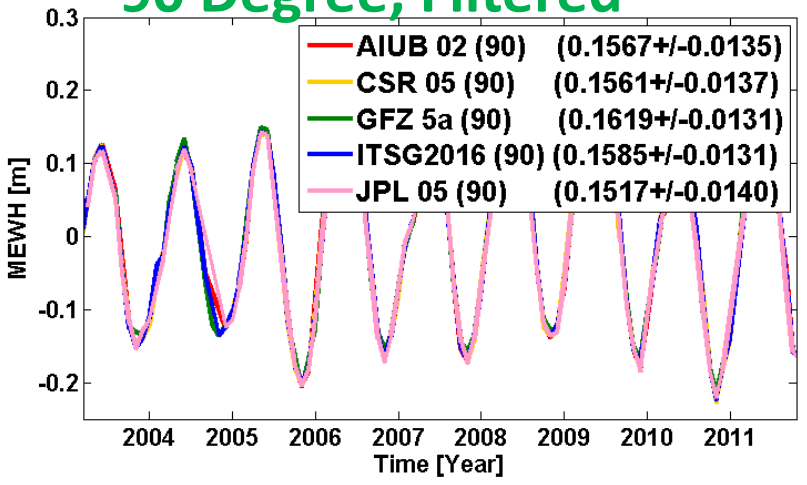


Tongji's new solution shows attenuated signal.

90 Degree, Unfiltered

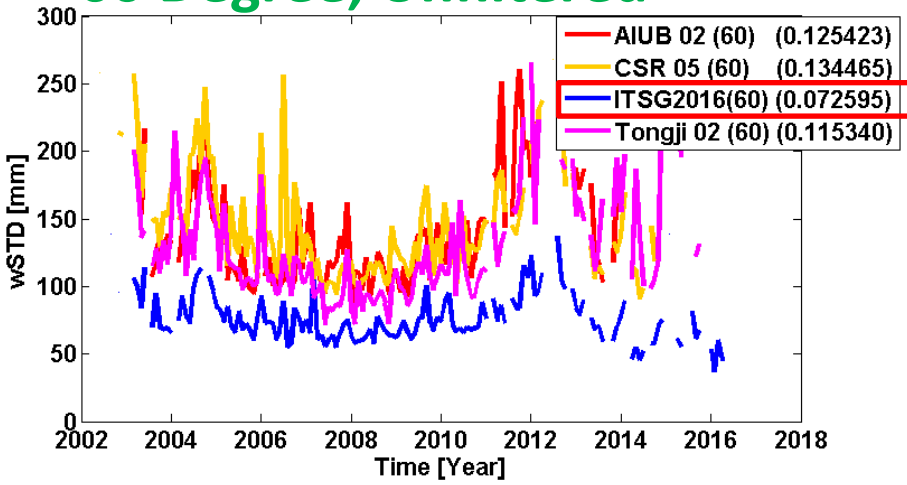


90 Degree, Filtered

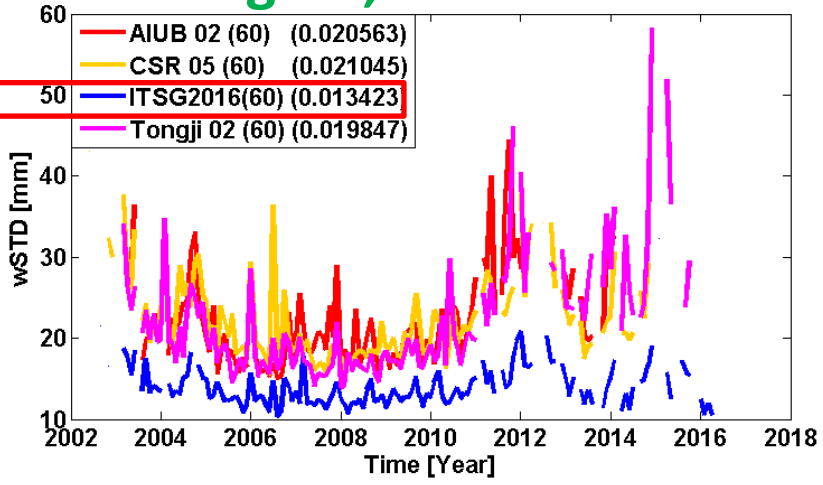


Comparison: Variability (wSTD over Oceans)

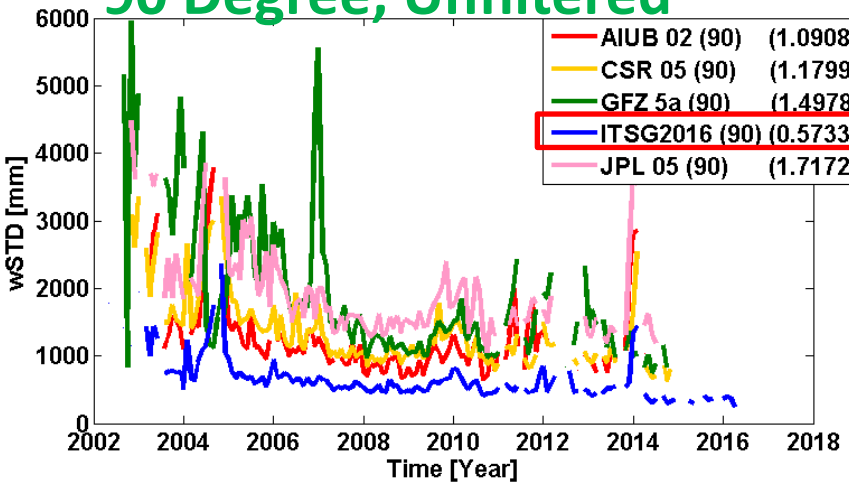
60 Degree, Unfiltered



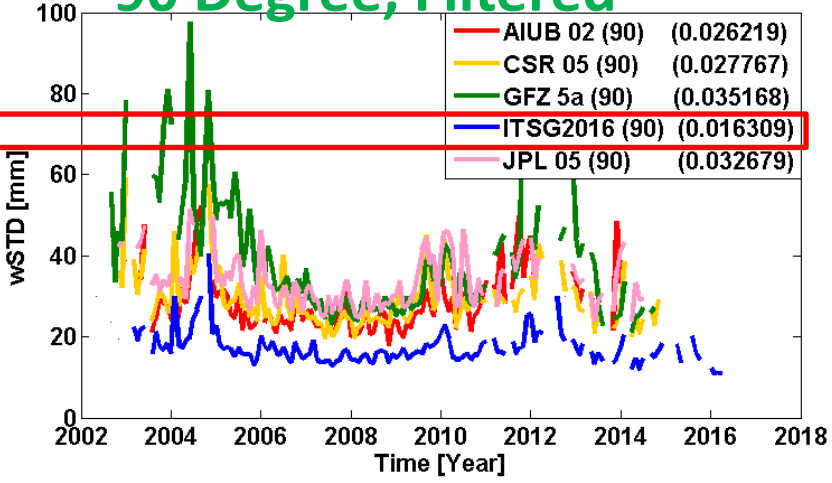
60 Degree, Filtered



90 Degree, Unfiltered



90 Degree, Filtered



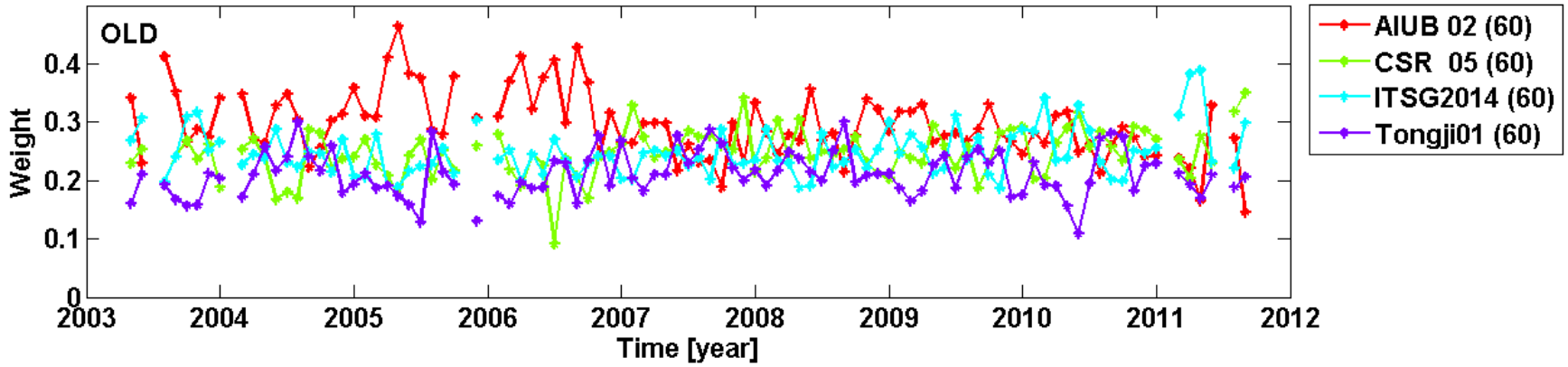
Combination: Weighting Schemes

Combined Solution (Max. Deg.)	Involved Individual Solutions
Combined Solution (60)	**AIUB 02, CSR 05, ITSG2016, Tongji 02**
Combined Solution (90)	**AIUB 02, CSR 05, GFZ 5a, ITSG2016, JPL 05**

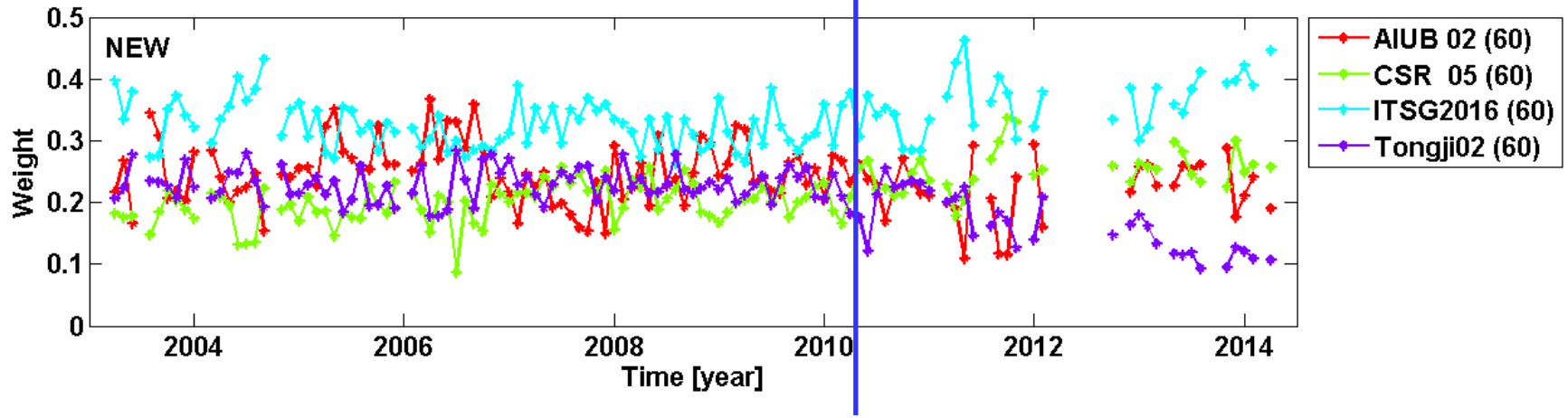
- **Equal weight:** (arithmetic mean)
- **Field-wise Single weight:** using (Individual – Arithmetic Mean)$^{-2}$
- **Weights using VCE** (Variance Component Estimation):
  - Iterative process
  - Weights and wMean are updated in each iteration step

Field-wise Weights: Degree 60

OLD **(without C20)**



NEW **Higher weights on ITSG solution**

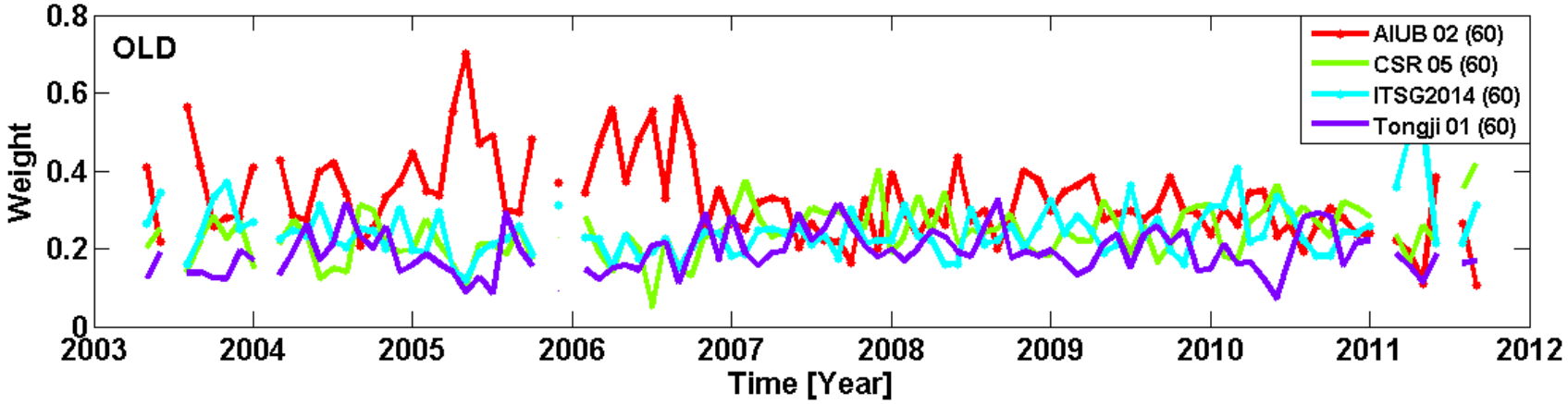


Difference in Tongji Solution: higher weights until 2010

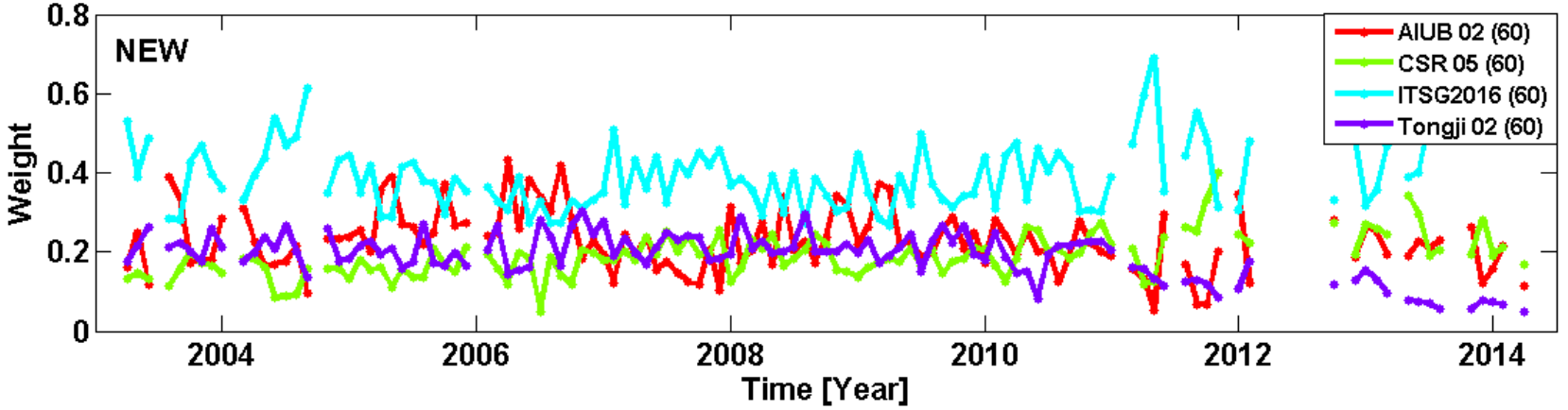
Weights from VCE method: Degree 60

(without C20)

OLD



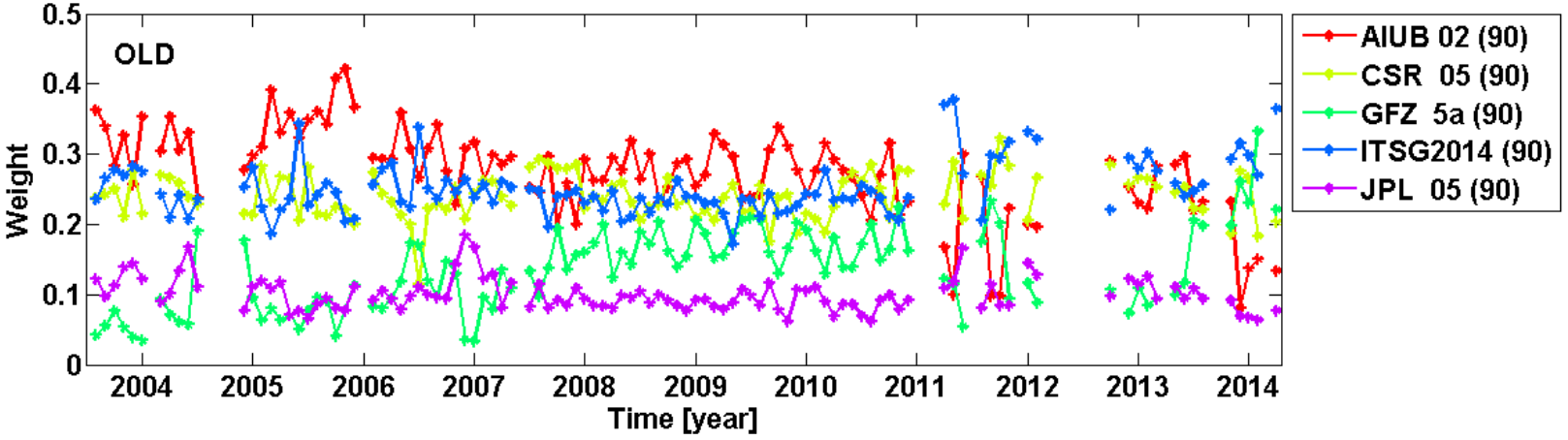
NEW



Field-wise Weights: Degree 90

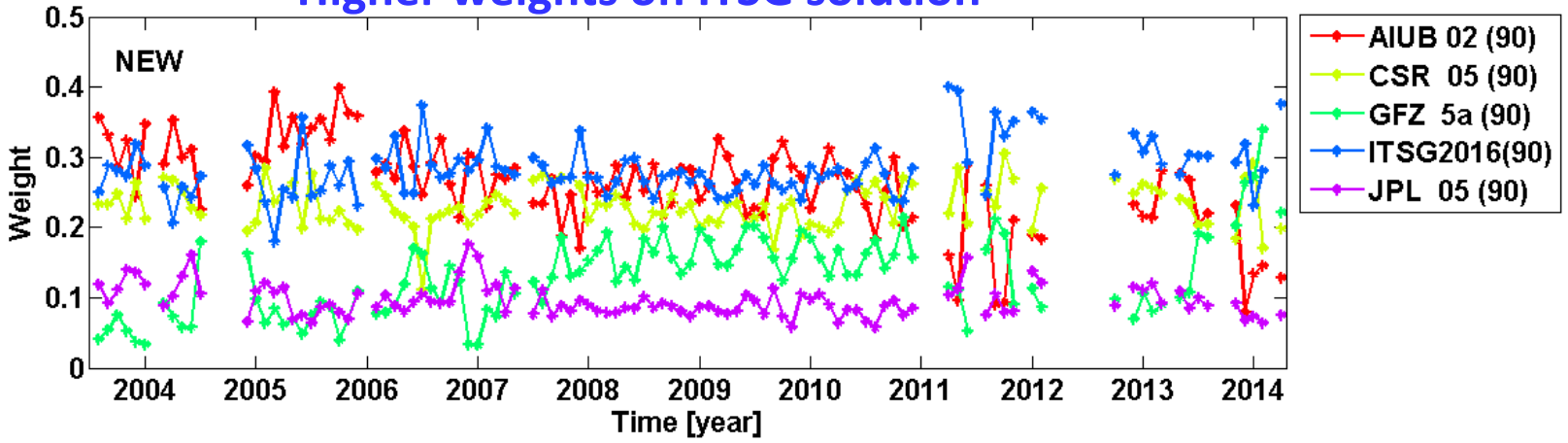
(without C20)

OLD



NEW

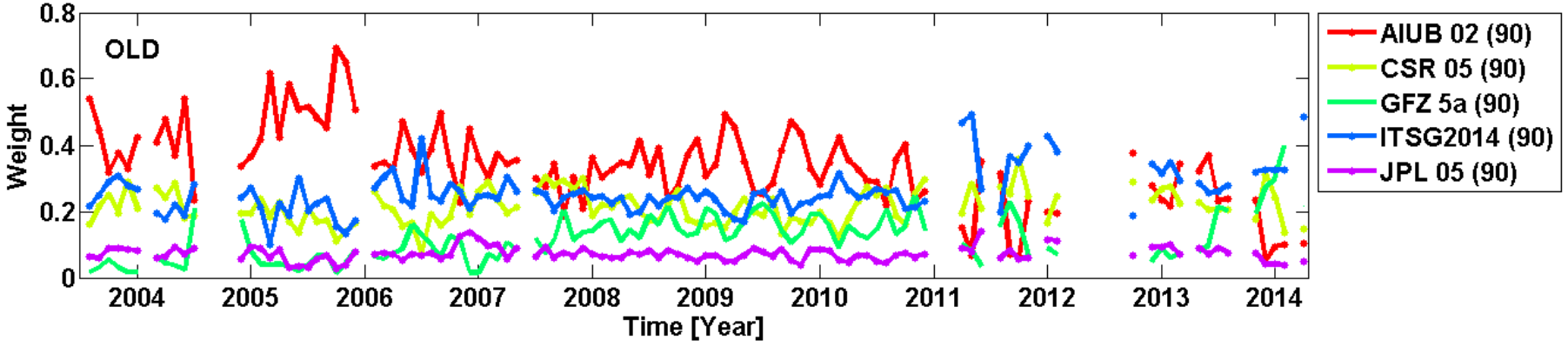
Higher weights on ITSG solution



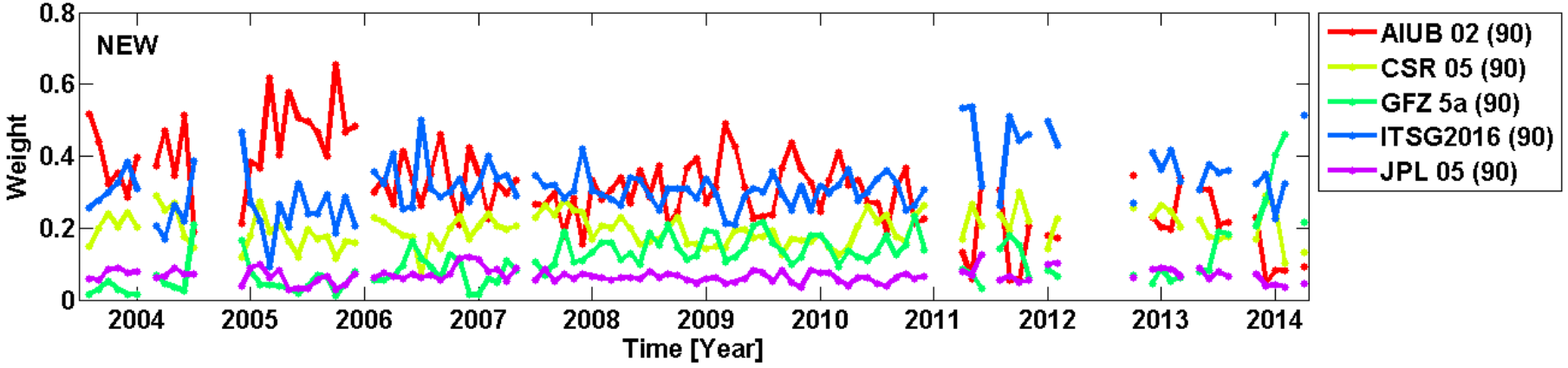
Weights from VCE method: Degree 90

(without C20)

OLD

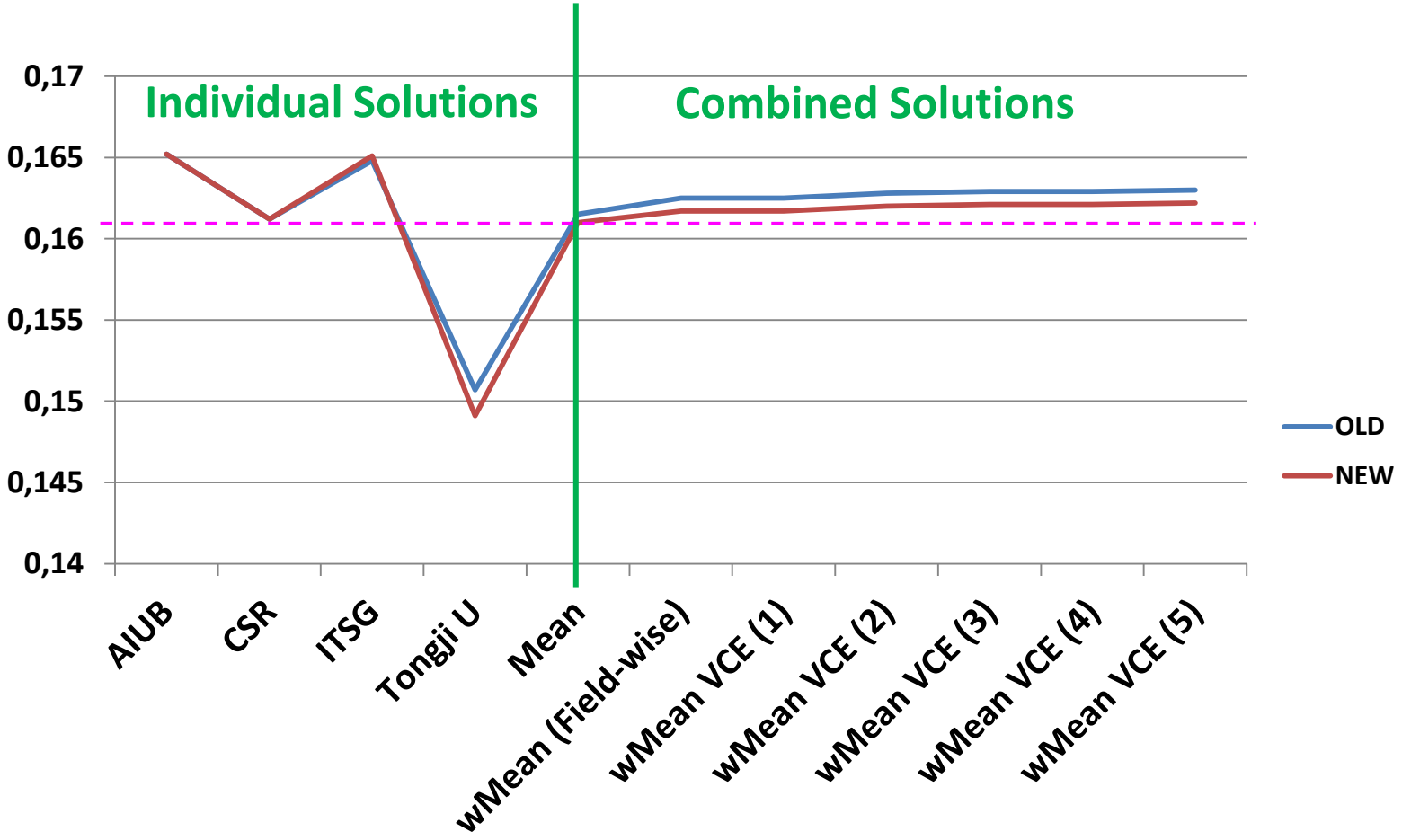


NEW



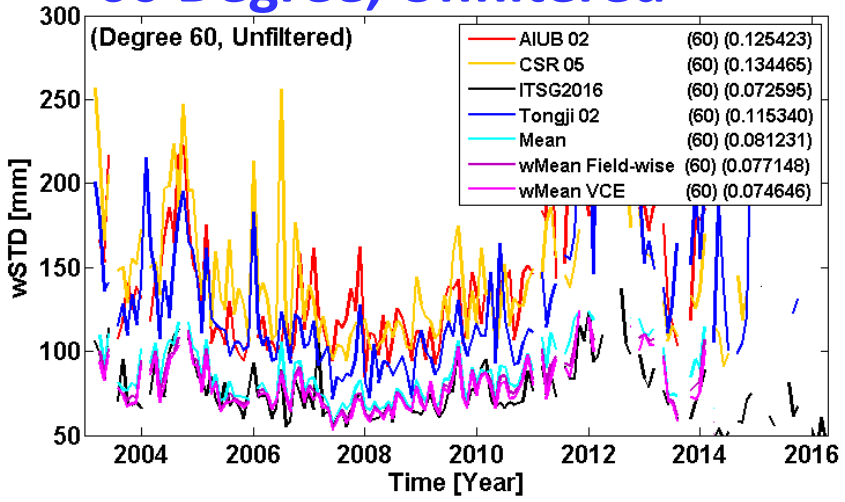
Amplitude of Annual Signal

in MEWH of Amazon River Basin (60 Degree, Unfiltered)

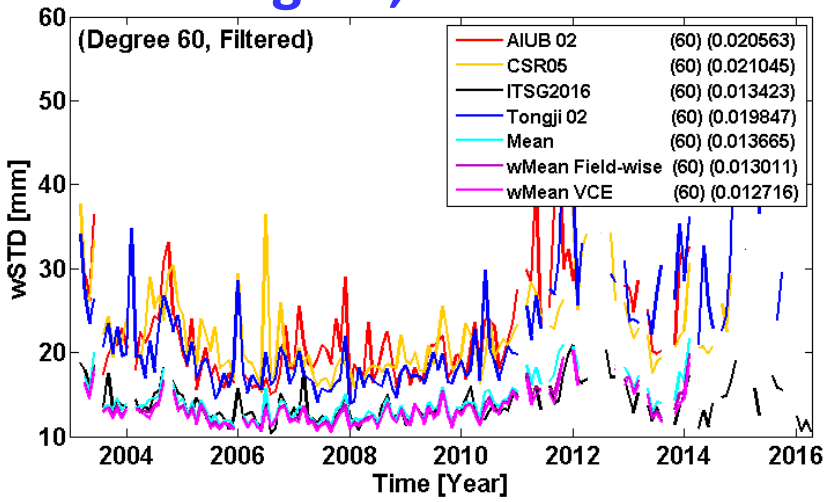


Variability: wSTD over Oceans

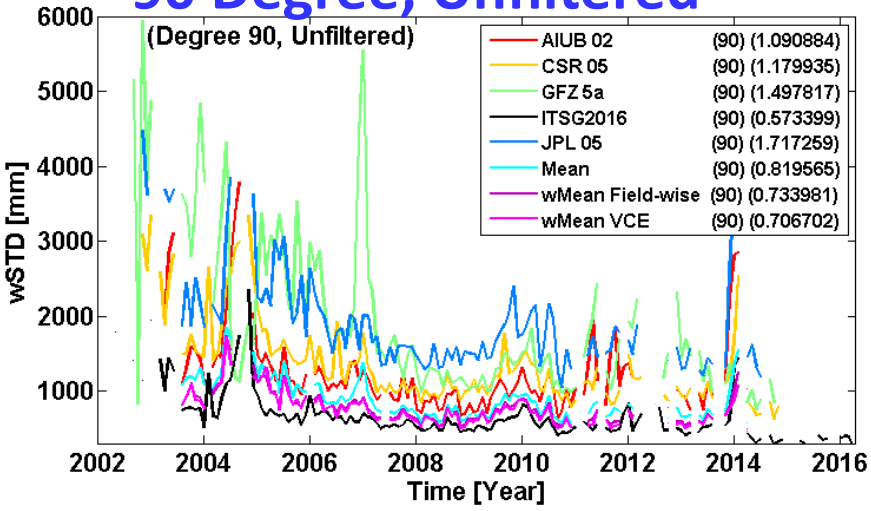
60 Degree, Unfiltered



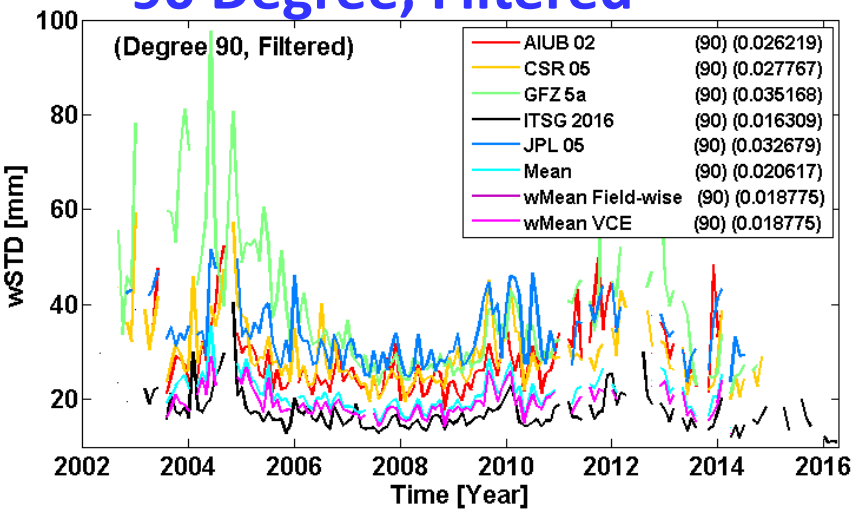
60 Degree, Filtered



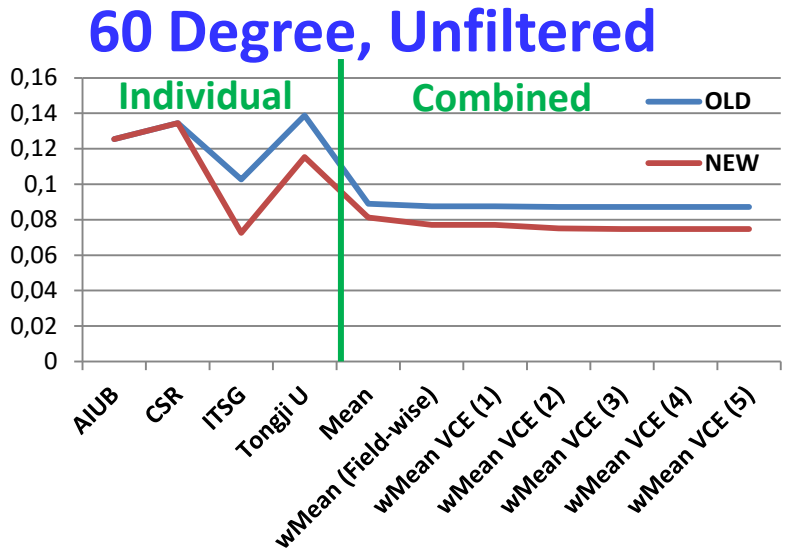
90 Degree, Unfiltered

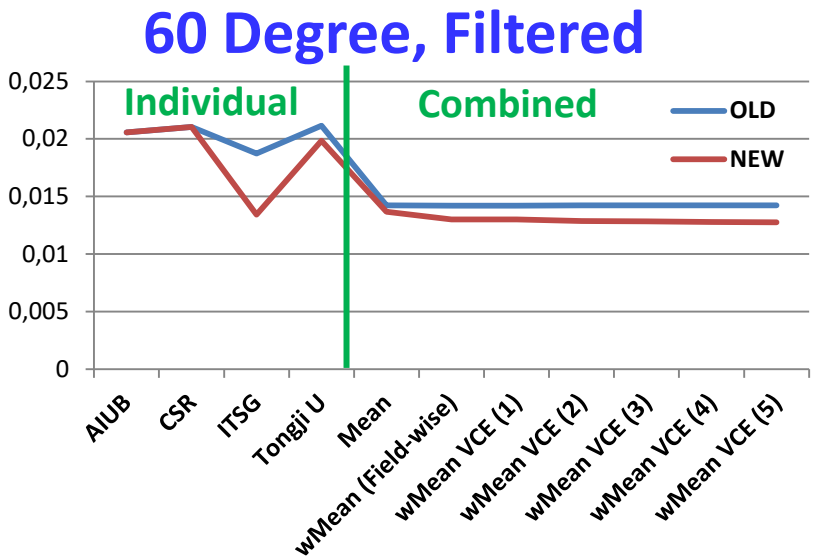


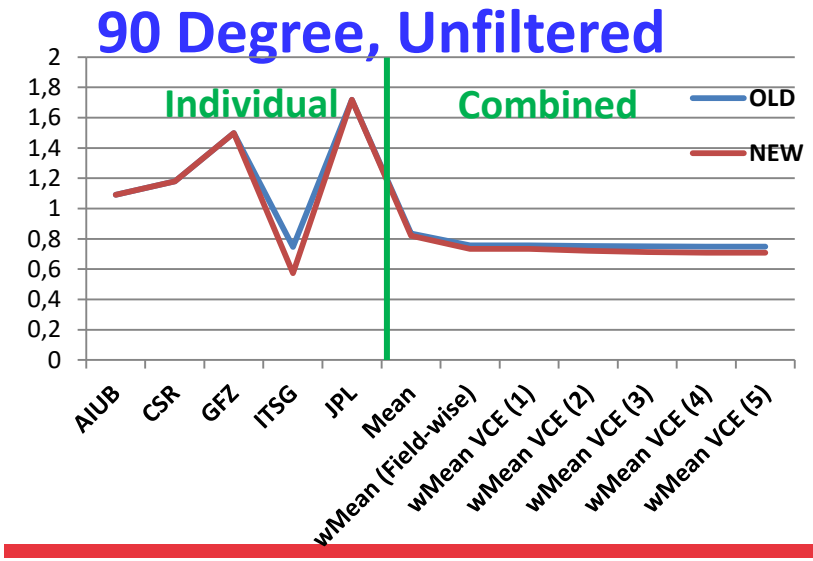
90 Degree, Filtered

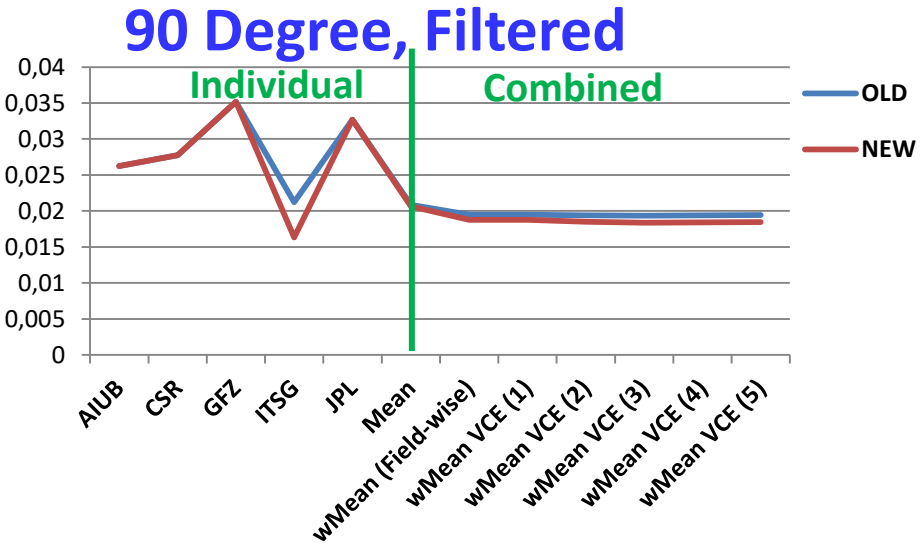


Variability: wSTD over Oceans









Summary and Conclusions

- **GRACE Monthly gravity field solutions**

  New release in 2016: ITSG2016 (60,90,120), Tongji U (60)

- **Comparison** (signal and variability)
  - Both ITSG and Tongji solutions are **improved** in the new releases.
  - **Tongji solution** shows **slightly attenuated signal**.

- **Combination** including the *newly released solutions*:
  - Weighting schemes: eqaul weights, Field-wise weights, and weights from ***VCE*** method
  - Involved individual solutions have different levels of variability

    → Combined solutions are not stronger in terms of variability
  - Better combined solutions are expected if the other processing centers also improve their soluitons in the next releases.